PATENT
Attorney Docket No. 401175/SAKAI

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

HIROSHI KAGE

Art Unit: Unknown

Application No.: Unknown

Examiner: Unknown

Filed: May 2, 2001

For: METHOD AND DEVICE FOR GENERATING A PERSON'S PORTRAIT, METHOD AND DEVICE FOR COMMUNICATIONS, AND COMPUTER PRODUCT

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE SPECIFICATION:

Replace the paragraph beginning at page 1, line 6 with:

The present invention relates to a technology for generating an image of a person's portrait in which, from a two-dimensional image containing a person's face picked up by an image sensor, a feature of the subject person is emphasized to generate the person's portrait or generate a deformed image of the person's portrait. This invention also relates to a method and a device for communication, and a computer readable recording medium which stores a computer program which, when executed on a computer realizes, the method according to the present invention.

Replace the paragraph beginning at page 1, line 18 with:

In recent years, it has become possible to send/receive electronic mail not only on a personal computer but also on a portable terminal. Furthermore, not only documents, but also a sender's portrait have been widely attached to the electronic mail. When creating such a portrait by using a conventional method, it is necessary for the user to manually make selections from prepared parts of several tens or more kinds, such as face outline parts, face parts and hairstyles, and combine them all together. In this case, a large number of combinations are available, and, as a result, a great workload is imposed on the user in an attempt to create a desired person's portrait. For this reason, there has been a strong demand for a device which can easily and automatically generate a person's portrait using an image of that person acquired by a camera. In order to create a person's portrait, such a device needs to automatically carry out a sequence of processes of extracting the face portion from the image, detecting eyes, mouth, etc., and replacing the desired parts with already prepared desired templates.

Replace the paragraph beginning at page 2, line 23 with:

(1) the face color is influenced by illumination conditions, resulting in a difficulty in detecting the face area in some cases;

IN THE CLAIMS:

Replace the indicated claims with:

1. (Amended) A person's portrait generation device comprising:

an image input section which picks up two-dimensional images containing a person's face, using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the face within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

2. (Amended) The person's portrait generation device according to claim 1, wherein, in the head area extracting section, an outline of the head area is obtained by combining a right-side profile and a left-side profile of the differential image.

4. (Amended) The person's portrait generation device according to claim 2, wherein the head area extracting section provides the head area obtained by a rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of an average person's head.

5. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face, using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

6. (Amended) The person's portrait generation device according to claim 5,

wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

8. (Amended) The person's portrait generation device according to claim 5, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

9. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

10. (Amended) The person's portrait generation device according to claim 9, wherein the face outline determining section determines outline of a jaw.

11. (Amended) The person's portrait generation device according to claim 9, wherein, in the face outline determining section, the skin color area is determined by converting an RGB value to an HSV value.

12. (Amended) The person's portrait generation device according to claim 9, wherein, in determining the skin color area in the face outline determining section, with respect to an average color near the characteristic features of the face, areas having

similar colors are used as face area candidates.

13. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of face parts.

14. (Amended) The person's portrait generation device according to claim 13, wherein the image processing section expresses a person's emotions by changing shape of a partial image at each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

15. (Amended) The person's portrait generation device according to claim 13, wherein the image processing section replaces partial images at an eye portion, a nose portion, and a mouth portion that are characteristic features of the face.

16. (Amended) A communication terminal comprising:

an image input section which picks up two-dimensional images containing a person's face using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the face within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired by the head area extracting section, the feature detection section, and the face outline determining section, wherein the person's portrait is transmitted and received through a communication unit.

17. (Amended) The communication terminal according to claim 16, wherein, in the head area extracting section, an outline of the head area is obtained by combining a right-side profile and a left-side profile of the differential image.

19. (Amended) The communication terminal according to claim 17, wherein the head area extracting section provides the head area obtained by a rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of an average person's head.

20 (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section, wherein the person's portrait is transmitted and

received through a communication unit.

21. (Amended) The communication terminal according to claim 20, wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

23. (Amended) The communication terminal according to claim 20, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

24. (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section, wherein the person's portrait is transmitted and received through a communication unit.

25. (Amended) The communication terminal according to claim 24, wherein the face outline determining section determines outline of a jaw.

26. (Amended) The communication terminal according to claim 24, wherein, in the face outline determining section, the skin color area is determined by converting an

RGB value to an HSV value.

27. (Amended) The communication terminal according to claim 24, wherein, in determining the skin color area in the face outline determining section, with respect to an average color near the characteristic features of the face, areas having similar colors are used as face area candidates.

28. (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of face parts, wherein the resulting person's portrait is transmitted and received through a communication unit.

29. (Amended) The communication terminal according to claim 28, wherein the image processing section expresses a person's emotions by changing shape of a partial image at each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

30. (Amended) The communication terminal according to claim 28, wherein the image processing section replaces partial images at an eye portion, a nose portion, and a mouth portion that are characteristic features of the face.

31. (Amended) A person's portrait generation method comprising:

picking up two-dimensional images containing a person's face using an image sensor;

extracting a head area from a differential image of a plurality of the two-dimensional images picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using output data obtained in extracting the head area, detecting position of characteristic features, and determining the border.

32. (Amended) The person's portrait generation method according to claim 31, wherein, in extracting the head area, an outline of the head area is obtained by combining a right-side profile and a left-side profile of the differential image.

33. (Amended) The person's portrait generation method according to claim 32, wherein the outline of the head area is obtained by eliminating noise components of the right-side profile and left-side profile by filtering.

34. (Amended) The person's portrait generation method according to claim 32, wherein extracting the head area provides the head area in a rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area, and a lower side is determined by a shape ratio constant of an average person's head.

35. (Amended) A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features and determining a border.

36. (Amended) The person's portrait generation method according to claim 35, wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

38. (Amended) The person's portrait generation method according to claim 35, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

39. (Amended) A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border.

40. (Amended) The person's portrait generation method according to claim 39, wherein, in determining a border, the outline of a jaw is determined.

41. (Amended) The person's portrait generation method according to claim 39,

wherein, in determining the border, the skin color area is determined by converting an RGB value to an HSV value.

42. (Amended) The person's portrait generation method according to claim 39, wherein, in determining a border, determining, with respect to an average color in the vicinity of the characteristic features of the face, areas having similar colors as face area candidates.

43. (Amended) A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of the face parts.

44. (Amended) The person's portrait generation method according to claim 43, wherein, changing shape of a partial image at each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face in treating the person's portrait to express the person's emotions.

45. (Amended) The person's portrait generation method according to claim 43, wherein, in treating the person's portrait, replacing partial images at an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

46. (Amended) A communication method using a communication terminal comprising:

picking up two-dimensional images containing a person's face using an image sensor;

extracting a head area from a differential image of a plurality of the two-dimensional images picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using output data obtained in extracting the head area, detecting position of characteristic features, and determining the border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

47. (Amended) A communication method using a communication terminal comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

48. (Amended) A communication method using a communication terminal that comprises:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

49. (Amended) A communication method using a communication terminal that comprises:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of the face parts; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

50. (Amended) A recording medium in which is recorded a person's portrait generation program for execution by a computer, and comprising:

a head area extracting program for extracting a head area of a person from a differential image of a plurality of two-dimensional images picked up by an image input section;

a feature detection program for detecting positions of characteristic features of the person's portrait by dividing the head area into face parts areas for respective face parts, finding projection data of binarized images for the respective face parts areas and detecting the position of each of the face parts based upon a center-of-gravity position of the projection data;

a face outline determining program for determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing program for creating a person's portrait in which the characteristics in the person's face are emphasized by changing the two-dimensional image with respect to each of the face parts.

Serial No. 09/852,257

IN THE ABSTRACT:

Replace the Abstract with:

ABSTRACT OF THE DISCLOSURE

A person's portrait generation device includes an image input section which picks up a two-dimensional image containing a person's face, using an image sensor. A head area extracting section extracts the head of the person from the image. A feature detection section detects the position of characteristic feature(s) of the face of that person. A face outline determining section determines a border between a face outline and a background. An image processing section generates a person's portrait in which the characteristic feature(s) of the face is emphasized.

REMARKS

The foregoing Amendment corrects translational errors and conforms the claims to United States practice.

Respectfully submitted,

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09809504 - 052401

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SPECIFICATION, CLAIMS AND ABSTRACT AS PRELIMINARILY AMENDED

Amendments to the paragraph beginning at page 1, line 6:

The present invention relates to a technology for generating an image of a person's portrait in which, from a two-dimensional image containing a person's face picked up by an image sensor, ~~the~~ a feature of the subject person is emphasized to generate the person's portrait or generate a deformed image of the person's portrait. This invention also relates to a method and a device for communication, and a computer readable recording medium which stores a computer program which, when executed on a computer realizes, the ~~methods~~ method according to the present invention.

Amendments to the paragraph beginning at page 1, line 18:

In recent years, it has become possible to send/receive electronic ~~mails~~ mail not only on a personal computer but also on a portable terminal. Furthermore, not only documents, but also a sender's portrait have been widely attached to the electronic ~~mails~~ mail. When creating such a portrait by using a conventional method, it is necessary for the user to manually make selections from prepared parts of several tens or more kinds,

such as face outline parts, face parts and hairstyles, and combine them all together. In this case, a large number of combinations are available, and, as a result, a great ~~amount of~~ workload is imposed on the user in an attempt to create a desired person's portrait. For this reason, there has been a strong demand for a device which can easily and automatically generate a person's portrait using an image of that person acquired by a camera. In order to create a person's portrait, such a device needs to automatically carry out a sequence of processes of extracting the face portion from the image, detecting eyes, mouth, etc., and replacing the desired parts with already prepared desired templates.

Amendments to the paragraph beginning at page 2, line 23:

(1) the face color is influenced by illumination conditions, resulting in a difficulty in detecting the face area~~;~~ in some cases;

Amendments to existing claims:

1. (Amended) A person's portrait generation device comprising:

an image input section which picks up ~~a~~ two-dimensional ~~image~~ images containing a person's face ~~by~~, using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the face within the ~~extracted~~ head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~ using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section.

2. (Amended) The person's portrait generation device according to claim 1, wherein, in the head area extracting section, ~~the~~ an outline of the head area is obtained by combining a right-side profile and a ~~lift-side~~ left-side profile of the differential image.

4. (Amended) The person's portrait generation device according to claim 2, wherein the head area extracting section provides the head area obtained by a ~~head~~ rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of ~~a general~~ an average person's head.

5. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~, using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area ~~thus~~ extracted into face ~~part~~ parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~ using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section.

6. (Amended) The person's portrait generation device according to claim 5, wherein the face parts ~~area is~~ areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

8. (Amended) The person's portrait generation device according to claim 5, wherein the position of characteristic features of the face is detected ~~by~~ based on a position of a maximum value of the projection data.

9. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the ~~extracted~~ head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~ using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section.

10. (Amended) The person's portrait generation device according to claim 9, wherein the face outline determining section determines ~~the~~ outline of ~~the~~ a jaw.

11. (Amended) The person's portrait generation device according to claim 9, wherein, in the face outline determining section, the skin color area is determined by converting an ~~inputted~~ RGB value to an HSV value.

12. (Amended) The person's portrait generation device according to claim 9, wherein, in determining the skin color area in the face outline determining section, with respect to an average color ~~in the vicinity of~~ near the characteristic features of the face, areas having similar colors are used as face area candidates.

13. (Amended) A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of ~~the~~ face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized by changing the two-dimensional image with respect to each of ~~the~~ face parts.

14. (Amended) The person's portrait generation device according to claim 13, wherein the image processing section expresses a person's emotions by changing ~~the~~ shape of a partial image at each of an eye portion, a ~~noise~~ nose portion, and a mouth portion that are the characteristic features of the face.

15. (Amended) The person's portrait generation device according to claim 13, wherein the image processing section replaces partial images at an eye portion, a ~~noise~~ nose portion, and a mouth portion that are characteristic features of the face.

16. (Amended) A communication terminal comprising:

an image input section which picks up ~~a~~ two-dimensional ~~image~~ images containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the face within the ~~extracted~~ head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~, using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section, wherein the ~~resulting~~ person's portrait is transmitted and received through a communication unit.

17. (Amended) The communication terminal according to claim 16, wherein, in the head area extracting section, ~~the~~ an outline of the head area is obtained by combining a right-side profile and a ~~lift-side~~ left-side profile of the differential image.

19. (Amended) The communication terminal according to claim 17, wherein the head area extracting section provides the head area obtained by a ~~head~~ rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of ~~a general~~ an average person's head.

20 (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area ~~thus~~ extracted into face ~~part~~ parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~ using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section, wherein the ~~resulting~~ person's portrait is transmitted and received through a communication unit.

21. (Amended) The communication terminal according to claim 20, wherein the face parts ~~area is~~ areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

23. (Amended) The communication terminal according to claim 20, wherein the position of characteristic features of the face is detected ~~by~~ based on a position of a maximum value of the projection data.

24. (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the ~~extracted~~ head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~ using data acquired ~~in~~ by the head area extracting section, the feature detection section, and the face outline determining section, wherein the ~~resulting~~ person's portrait is transmitted and received through a communication unit.

25. (Amended) The communication terminal according to claim 24, wherein the face outline determining section determines ~~the~~ outline of ~~the~~ a jaw.

26. (Amended) The communication terminal according to claim 24, wherein, in the face outline determining section, the skin color area is determined by converting an ~~inputted~~ RGB value to an HSV value.

27. (Amended) The communication terminal according to claim 24, wherein, in determining the skin color area in the face outline determining section, with respect to an average color ~~in the vicinity of~~ near the characteristic features of the face, areas having similar colors are used as face area candidates.

28. (Amended) A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of ~~the~~ face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized by changing the two-dimensional image with respect to each of ~~the~~ face parts, wherein the resulting person's portrait is transmitted and received through a communication unit.

29. (Amended) The communication terminal according to claim 28, wherein the image processing section expresses a person's emotions by changing ~~the~~ shape of a partial image at each of an eye portion, a ~~noise~~ nose portion, and a mouth portion that are the characteristic features of the face.

30. (Amended) The communication terminal according to claim 28, wherein the image processing section replaces partial images at an eye portion, a ~~noise~~ nose portion, and a mouth portion that are characteristic features of the face.

31. (Amended) A person's portrait generation method comprising:

~~an image input step of~~ picking up ~~a~~ two-dimensional ~~image~~ images containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from a differential image of a plurality of the two-dimensional images picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features within the ~~extracted~~ head area extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area; and

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face are emphasized based upon the two-dimensional image ~~by,~~ using output data obtained in extracting the head area ~~extracting step, the feature detection step~~ detecting position of characteristic features, and ~~the face outline~~ determining ~~step~~ the border.

32. (Amended) The person's portrait generation method according to claim 31, wherein, in extracting the head area ~~extracting step, the~~ an outline of the head area is obtained by combining a right-side profile and a ~~lift-side~~ left-side profile of the differential image.

33. (Amended) The person's portrait generation method according to claim 32, wherein the outline of the head area is obtained by eliminating noise components of the right-side profile and left-side profile ~~through a~~ by filtering ~~step~~.

34. (Amended) The person's portrait generation method according to claim 32, wherein extracting the head area ~~extracting step~~ provides the head area ~~that is obtained by~~ in a ~~head~~ rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area, and a lower side is determined by a shape ratio constant of ~~a general~~ an average person's head.

35. (Amended) A person's portrait generation method comprising:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features of the face by dividing the head area ~~thus~~ extracted into face ~~part~~ parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area; and

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by,~~ using data acquired in extracting the head area ~~extraction step, the feature detection step~~ detecting position of the characteristic features and ~~the face outline~~ determining ~~step~~ a border.

36. (Amended) The person's portrait generation method according to claim 35, wherein the face parts ~~area is~~ areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

38. (Amended) The person's portrait generation method according to claim 35, wherein the position of characteristic features of the face is detected ~~by~~ based on a position of a maximum value of the projection data.

39. (Amended) A person's portrait generation method comprising:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features within the ~~extracted~~ head area extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by,~~ using data acquired in extracting the head area ~~extraction step, the feature detection step~~ detecting position of the characteristic features, and ~~the face outline~~ determining ~~step~~ a border.

40. (Amended) The person's portrait generation method according to claim 39, wherein, ~~in the face outline determining step~~ determining a border, the outline of ~~the~~ a jaw is determined.

41. (Amended) The person's portrait generation method according to claim 39, wherein, ~~in the face outline determining step~~ determining the border, the skin color area is determined by converting an ~~inputted~~ RGB value to an HSV value.

42. (Amended) The person's portrait generation method according to claim 39, wherein, ~~the~~ in determining ~~method in the face outline~~ a border, determining ~~step~~, with respect to an average color in the vicinity of the characteristic features of the face, areas having similar colors ~~are used~~ as face area candidates.

43. (Amended) A person's portrait generation method comprising:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area; and

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized by changing the two-dimensional image with respect to each of the face parts.

44. (Amended) The person's portrait generation method according to claim 43, wherein ~~the image processing step expresses a person's emotions by~~, changing ~~the~~ shape of a partial image at each of an eye portion, a ~~noise~~ nose portion, and a mouth portion that are the characteristic features of the face in treating the person's portrait to express the person's emotions.

45. (Amended) The person's portrait generation method according to claim 43, wherein ~~the image processing step replaces~~, in treating the person's portrait, replacing partial images at an eye portion, a ~~noise~~ nose portion, and a mouth portion that are the characteristic features of the face.

46. (Amended) A communication method using a communication terminal ~~that comprises~~ comprising:

~~an image input step of~~ picking up ~~a~~ two-dimensional ~~image~~ images containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from a differential image of a plurality of the two-dimensional images picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features within the ~~extracted~~ head area extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area;

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by~~, using output data obtained in extracting the head area ~~extracting step~~, ~~the feature detection step~~ detecting position of characteristic features, and determining the border; and

~~a step in which,~~ when a communication is received, the person's portrait thus created is displayed so as to inform ~~the~~ a user of ~~the~~ receipt of the communication.

47. (Amended) A communication method using a communication terminal ~~that comprises~~ comprising:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features of the face by dividing the head area ~~thus~~ extracted into face ~~part~~ parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area;

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by,~~ using data acquired in extracting the head area ~~extraction step, the feature detection step~~ detecting position of the characteristic features, and ~~the face outline~~ determining ~~step~~ a border; and

~~a step in which,~~ when a communication is received, the person's portrait thus created is displayed so as to inform ~~the~~ a user of ~~the~~ receipt of the communication.

48. (Amended) A communication method using a communication terminal that comprises:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features within the ~~extracted~~ head area extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image;

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized based upon the two-dimensional image ~~by,~~ using data acquired in extracting the head area ~~extraction step, the feature detection step~~ detecting position of the characteristic features, and ~~the face outline~~ determining ~~step~~ a border; and

~~a step in which,~~ when a communication is received, the person's portrait thus created is displayed so as to inform ~~the~~ a user of ~~the~~ receipt of the communication.

49. (Amended) A communication method using a communication terminal that comprises:

~~an image input step of~~ picking up a two-dimensional image containing a person's face ~~by~~ using an image sensor;

~~a head area extracting step of~~ extracting a head area from the image picked up ~~in the image input step~~;

~~a feature detection step of~~ detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

~~a face outline determining step of~~ determining a border between a face outline and a background within the head area;

~~an image processing step of~~ creating a person's portrait in which the ~~characteristics in~~ characteristic features of the ~~person's~~ face ~~is~~ are emphasized by changing the two-dimensional image with respect to each of the face parts; and

~~a step in which,~~ when a communication is received, the person's portrait thus created is displayed so as to inform ~~the~~ a user of ~~the~~ receipt of the communication.

50. (Amended) A recording medium in which is recorded a person's portrait generation program ~~which is executed~~ for execution by a computer, and ~~comprises~~ comprising:

a head area extracting program for extracting a head area of a person from a differential image of a plurality of two-dimensional images picked up by an image input section;

a feature detection program for detecting positions of characteristic features of the person's portrait by dividing the head area into face ~~part~~ parts areas for respective face parts, finding projection data of binarized images for the respective face parts areas and detecting the position of each of the face parts based upon a center-of-gravity position of the projection data;

a face outline determining program for determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing program for creating a person's portrait in which the characteristics in the person's face ~~is~~ are emphasized by changing the two-dimensional image with respect to each of the face parts.

Amendments to the abstract:

ABSTRACT OF THE DISCLOSURE

~~The~~ A person's portrait generation device ~~comprises~~ includes an image input section which picks up a two-dimensional image containing a person's face ~~by,~~ using an image sensor. A head area extracting section extracts the head of the person from the image. A feature detection section detects the position of characteristic feature(s) of the face of that person. A face outline determining section determines a border between a face outline and a background. An image processing section generates a person's portrait in which the characteristic feature(s) of the face is emphasized.

PATENT
Attorney Docket No. 401175/SAKAI

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

HIROSHI KAGE

Art Unit: Unknown

Application No.: Unknown

Examiner: Unknown

Filed: May 2, 2001

For: METHOD AND DEVICE FOR GENERATING A PERSON'S PORTRAIT, METHOD AND DEVICE FOR COMMUNICATIONS, AND COMPUTER PRODUCT

CLAIMS PENDING AFTER PRELIMINARY AMENDMENT

1. A person's portrait generation device comprising:

an image input section which picks up two-dimensional images containing a person's face, using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the face within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

2. The person's portrait generation device according to claim 1, wherein, in the head area extracting section, an outline of the head area is obtained by combining a right-

side profile and a left-side profile of the differential image.

3. The person's portrait generation device according to claim 2, wherein the outline of the head area is obtained by eliminating noise components of the right-side profile and left-side profile through filtering.

4. The person's portrait generation device according to claim 2, wherein the head area extracting section provides the head area obtained by a rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of an average person's head.

5. A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face, using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

6. The person's portrait generation device according to claim 5, wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

7. The person's portrait generation device according to claim 5, wherein the position of characteristic features of the face is detected based on a position of a center-of-gravity of the projection data.

8. The person's portrait generation device according to claim 5, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

9. A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section.

10. The person's portrait generation device according to claim 9, wherein the face outline determining section determines outline of a jaw.

11. The person's portrait generation device according to claim 9, wherein, in the face outline determining section, the skin color area is determined by converting an RGB value to an HSV value.

12. The person's portrait generation device according to claim 9, wherein, in determining the skin color area in the face outline determining section, with respect to an

average color near the characteristic features of the face, areas having similar colors are used as face area candidates.

13. A person's portrait generation device comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of face parts.

14. The person's portrait generation device according to claim 13, wherein the image processing section expresses a person's emotions by changing shape of a partial image at each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

15. The person's portrait generation device according to claim 13, wherein the image processing section replaces partial images at an eye portion, a nose portion, and a mouth portion that are characteristic features of the face.

16. A communication terminal comprising:

an image input section which picks up two-dimensional images containing a person's face using an image sensor;

a head area extracting section which extracts a head area from a differential image of a plurality of the two-dimensional images picked up by the image input section;

a feature detection section which detects position of characteristic features of the

face within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired by the head area extracting section, the feature detection section, and the face outline determining section, wherein the person's portrait is transmitted and received through a communication unit.

17. The communication terminal according to claim 16, wherein, in the head area extracting section, an outline of the head area is obtained by combining a right-side profile and a left-side profile of the differential image.

18. The communication terminal according to claim 17, wherein the outline of the head area is obtained by eliminating noise components of the right-side profile and left-side profile through filtering.

19. The communication terminal according to claim 17, wherein the head area extracting section provides the head area obtained by a rectangular shape in which a left side, a right side, and an upper side are determined by the outline of the head area and a lower side is determined by a shape ratio constant of an average person's head.

20 A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

a face outline determining section which determines a border between a face

outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and the face outline determining section, wherein the person's portrait is transmitted and received through a communication unit.

21. The communication terminal according to claim 20, wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

22. The communication terminal according to claim 20, wherein the position of characteristic features of the face is detected based on a position of a center-of-gravity of the projection data.

23. The communication terminal according to claim 20, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

24. A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features within the head area extracted;

a face outline determining section which determines a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image using data acquired by the head area extracting section, the feature detection section, and

the face outline determining section, wherein the person's portrait is transmitted and received through a communication unit.

25. The communication terminal according to claim 24, wherein the face outline determining section determines outline of a jaw.

26. The communication terminal according to claim 24, wherein, in the face outline determining section, the skin color area is determined by converting an RGB value to an HSV value.

27. The communication terminal according to claim 24, wherein, in determining the skin color area in the face outline determining section, with respect to an average color near the characteristic features of the face, areas having similar colors are used as face area candidates.

28. A communication terminal comprising:

an image input section which picks up a two-dimensional image containing a person's face using an image sensor;

a head area extracting section which extracts a head area from the image picked up by the image input section;

a feature detection section which detects position of characteristic features of the face for each of face parts within the head area that has been extracted;

a face outline determining section which determines a border between a face outline and a background within the head area; and

an image processing section which generates a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of face parts, wherein the resulting person's portrait is transmitted and received through a communication unit.

29. The communication terminal according to claim 28, wherein the image processing section expresses a person's emotions by changing shape of a partial image at

each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

30. The communication terminal according to claim 28, wherein the image processing section replaces partial images at an eye portion, a nose portion, and a mouth portion that are characteristic features of the face.

31. A person's portrait generation method comprising:

picking up two-dimensional images containing a person's face using an image sensor;

extracting a head area from a differential image of a plurality of the two-dimensional images picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using output data obtained in extracting the head area, detecting position of characteristic features, and determining the border.

32. The person's portrait generation method according to claim 31, wherein, in extracting the head area, an outline of the head area is obtained by combining a right-side profile and a left-side profile of the differential image.

33. The person's portrait generation method according to claim 32, wherein the outline of the head area is obtained by eliminating noise components of the right-side profile and left-side profile by filtering.

34. The person's portrait generation method according to claim 32, wherein extracting the head area provides the head area in a rectangular shape in which a left side,

a right side, and an upper side are determined by the outline of the head area, and a lower side is determined by a shape ratio constant of an average person's head.

35. A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features and determining a border.

36. The person's portrait generation method according to claim 35, wherein the face parts areas are determined by relative positional information of the face parts with respect to the head area preliminarily found.

37. The person's portrait generation method according to claim 35, wherein the position of characteristic features of the face is detected based on a position of a center-of-gravity of the projection data.

38. The person's portrait generation method according to claim 35, wherein the position of characteristic features of the face is detected based on a position of a maximum value of the projection data.

39. A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border.

40. The person's portrait generation method according to claim 39, wherein, in determining a border, the outline of a jaw is determined.

41. The person's portrait generation method according to claim 39, wherein, in determining the border, the skin color area is determined by converting an RGB value to an HSV value.

42. The person's portrait generation method according to claim 39, wherein, in determining a border, determining, with respect to an average color in the vicinity of the characteristic features of the face, areas having similar colors as face area candidates.

43. A person's portrait generation method comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

determining a border between a face outline and a background within the head area; and

creating a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of the face parts.

44. The person's portrait generation method according to claim 43, wherein, changing shape of a partial image at each of an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face in treating the person's portrait to express the person's emotions.

45. The person's portrait generation method according to claim 43, wherein, in treating the person's portrait, replacing partial images at an eye portion, a nose portion, and a mouth portion that are the characteristic features of the face.

46. A communication method using a communication terminal comprising:

picking up two-dimensional images containing a person's face using an image sensor;

extracting a head area from a differential image of a plurality of the two-dimensional images picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using output data obtained in extracting the head area, detecting position of characteristic features, and determining the border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

47. A communication method using a communication terminal comprising:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face by dividing the head area extracted into face parts areas for respective face parts and finding projection data of binarized images for the respective face parts areas;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

48. A communication method using a communication terminal that comprises:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features within the head area extracted;

determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image;

creating a person's portrait in which the characteristic features of the face are emphasized based upon the two-dimensional image, using data acquired in extracting the head area, detecting position of the characteristic features, and determining a border; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

49. A communication method using a communication terminal that comprises:

picking up a two-dimensional image containing a person's face using an image sensor;

extracting a head area from the image picked up;

detecting position of characteristic features of the face for each of the face parts within the head area that has been extracted;

determining a border between a face outline and a background within the head area;

creating a person's portrait in which the characteristic features of the face are emphasized by changing the two-dimensional image with respect to each of the face parts; and

when a communication is received, the person's portrait thus created is displayed so as to inform a user of receipt of the communication.

50. A recording medium in which is recorded a person's portrait generation program for execution by a computer, and comprising:

a head area extracting program for extracting a head area of a person from a differential image of a plurality of two-dimensional images picked up by an image input section;

a feature detection program for detecting positions of characteristic features of the person's portrait by dividing the head area into face parts areas for respective face parts, finding projection data of binarized images for the respective face parts areas and detecting the position of each of the face parts based upon a center-of-gravity position of the projection data;

a face outline determining program for determining a border between a face outline and a background within the head area by specifying a skin color area of the two-dimensional image; and

an image processing program for creating a person's portrait in which the characteristics in the person's face are emphasized by changing the two-dimensional image with respect to each of the face parts.